# IMPROVING THERMO-MECHANICAL PROPERTIES OF 3D PRINTOUTS VIA SLA BY TUNING GRAFT DENSITY OF BIFUNCTIONALIZED GO

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Surface functionalization of graphene oxide (GO) is one of the best ways to achieve homogeneous dispersions of GO within polymeric matrices and composites. Nonetheless, there are still few studies on how the level of GO functionalization affects the macroscopic properties of three-dimensional (3D) printed nanocomposites. Herein, a one-step microwave-assisted synthesis presents fast and straightforward surface bifunctionalization of GO with a controlled ratio of NH2/NH3+ groups at low, medium, and high functionalization levels (AGOL, AGOM, and AGOH). A plateau of maximum functionalization (Gφ = 4.9 µmol/m2 = 2.9 molecules/nm2) was reached, suggesting that full coverage of the GO surface is achievable. Stereolithographic (SLA) 3D-printed nanocomposites were obtained using ultralow loads (0.01 wt %) of each bifunctionalized material. This ultralow amount was sufficient to enhance thermal stability (up to 4 °C) and a significant increase in the glass transition temperature (93 °C ≤ Tg ≤ 120 °C). Interestingly, we found that low and medium grafting density promotes a ductile material (ε > 5%); meanwhile, a high graft density produces brittle materials. Also, we observe that the toughness can be tuned as a function of the graft density (AGOH: 24 MPa, AGOM: 342 MPa, AGOL: 562 MPa) at ultralow loadings. The 3D-printed nanocomposites using GO with low graft density (AGOL) increase their tensile strain by 90% in comparison with the control sample (without filler). Finally, the underlying mechanisms were discussed to explain the findings.

**Keywords:** 3D Printing, Bi-Functionalized Graphene, Mechanical Properties

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